Use of a Tissue Auto Fluorescence Detection Device (VELscope®) for the Diagnosis of Fungal Infections of the Oral Cavity

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Abstract

Mycotic infections of the oral cavity are caused by members of the genus Candida. In particular, C. albicans was found to be responsible for 80% of oral mycoses, however about 150 other members of the same genus such as C. tropicalis, C. parapsilosis, C. krusei, C. guillermondii, C. glabrata and C. dubliniensis have been isolated from this type of infection. The name Candida derives from the Latin candidus, which means white, candid, referring to the characteristic clinical aspect of the pseudomembranes that are formed during infection. Candida albicans is a commensal in the oral cavity of the 40-65% of the adult human population. In healthy individuals this colonization remains benign. Under immunodeficiency conditions, though, an infection can happen. Diagnosis of oral candidiasis is usually based on clinical aspects, patients' symptoms and risk factors.

The timely diagnosis of invasive mycoses is mainly based on clinical suspicion and knowledge of the risk factors to which the patient is exposed. Although specific fungi can be associated with classic clinical pictures of infection, unfortunately, in most cases the clinical symptoms and signs that are observed are not specific for fungal infections and are often not useful for distinguishing bacterial infections from fungal infections or from autoimmune diseases. The diagnosis of fungal infections is based on three basic laboratory approaches: microbiological, immunological, and histopathological. The identification of the fungus can take place through morphological and biochemical recognition, while for the diagnosis of invasive candidiasis and for the differentiation of C. ablicans and C. dublinensis species the recognition is genetic and immunological.

Mucosal infections are generally best diagnosed based on clinical evidence, direct microscopic examination and mucosal secretions or scraping, as crops often produce growth that represents only the resident microbial population or even contaminating microorganisms.

Direct microscopic examination of tissue sections and clinical specimens is considered to be one of the fastest and least expensive methods in both biological and economic terms for diagnosing fungal infections. The detection under the microscope of yeasts or hyphal structures takes, in fact, less than an hour. The samples must be collected aseptically or after appropriate disinfection of the site to be sampled and sent in a sterile container with perfect seal, accompanied by adequate medical and clinical data. Furthermore, the material to be sampled must be sent in a short time and in quantities suitable for making a diagnosis.

The natural fluorescence of the tissues, or the auto fluorescence, is the property of a substance, when it is hit by a radiation, to re-emit other radiation, whose wavelength depends on that of the exciting radiation and on the nature of the substance itself. Those responsible for the natural fluorescence of the tissues are the fluorophores, which, excited with light of appropriate wavelength, for example blue light, emit their own light of greater wavelength, for example green. The fraction of incident light that is normally reflected by a surface is called reflectance, and is usually of much greater intensity than the fluorescence induced by incident light. Consequently, the auto fluorescence cannot be perceived without first blocking the reflected light and this objective can be achieved thanks to the use of specific devices in the examination of the tissues, such as the VELscope® handpiece, equipped with filters capable of completely blocking the blue light emission and that within their system have a technology to improve the vision of fluorescence. Tissue auto fluorescence has been adopted in the screening of precancerous lesions in several clinical studies, not only in carcinoma of the oral cavity, but also in other districts, studying the molecular basis that allows the identification of tissue alteration.

The VELscope Vx system is a direct visualization system of the natural fluorescence of tissues, which can be used as an auxiliary instrument for clinical examination during the inspection of the oral cavity. It is manufactured by LED Dental Inc., 235-5589 Byrne Road, Burnaby BC, Canada.

The VELscope Vx handpiece and its components are produced with CE certificate of conformity according to the Swedish national legislation for medical devices LVFS 2003: 11 (Medical Device Directive 93/42 / EEC).

VELscope® reveals natural tissues fluorescence. This latter is produced by fluorophores of the oral mucosa: FAD+, collagen cross-links, keratin, porphyrin, and fibrin. There are as well tissue components that decrease auto fluorescence, that is, hemoglobin and melanin. Any biochemical variation of these elements will also produce an alteration of tissue fluorescence. For this reason, fluorescence is used for the screening of oral cancer and bacterial and fungal oral infections. Tissues fluorescence is usually not visible with naked eyes; therefore, a proper filter is present on VELscope® device.

Aim

The aim of this study is to determine sensitivity and specificity of VELscope® in the diagnosis of oral mycosis.

Materials and Methods:

29 adult patients, including 22 female and 6 male, aged between 31 and 82 were enrolled. Positive outcomes of VELscope® was compared to the positive outcomes of the microbiological oral swab and the cytological smear on slides. The study was approved by the Padua Hospital Ethical Committee. The Siemel method was used in the statistical analysis.

Results:

VELscope® sensitivity was equal to 0.9167, CI95%=(0.6152-0.9979), its specificity was equal to 0.1667, CI95%=(0.0209-0.4841).

The likelihood positive ratio (LR+) was of 1.1 CI95%=(0.811-1.493) and LR- of 0.5 CI95%=(0.052-4.807).

Conclusions:

The frequent presence of Candida as a commensal within the oral cavity makes laboratory diagnosis difficult, since both microbiological and cytological analysis can find the presence of Candida when it is not pathological, or interpret a low presence of hyphae as an outcome negative, when they are the cause of infection.

All patients had local or systemic risk factors for oral candidiasis. Such clinical pictures, however, are also the cause of mucous lesions that appear to the VELscope® handpiece as a loss of tissue autofluorescence, resulting positive for this examination.

VELscope® sensitivity resulted higher than its specificity. High false positive ratio is probably due to the presence of autoimmune disease on the oral cavity together with the mycotic infection. Although, due to the small sample size, wide confidence intervals and low LR+ and LR- do not show a conclusive statistical value.

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